Indian J. Genet., 59(3): 351-356 (1999)

A POST-HARVEST STUDY OF GENETIC DIVERGENCE IN CUT ROSES

L. C. DE, S. D. WAHI AND S. K. BHATTACHARJEE*

Division of Floriculture and Landscaping I.A.R.I, New Delhi 110012

(Received: February 6, 1996; accepted June 30, 1999)

ABSTRACT

Thirty two varieties of cut flower roses were evaluated for their post- harvest quality parameters. There was wide variability for water uptake, vase life, weight loss, and flower diameter. The heritability estimates of all the four traits were high and of the same order. Water uptake had moderate correlation with vase life and weight loss. Vase-life was negatively correlated with the flower diameter. Loss in flower weight and vase life had significant genetic but non-significant phenotypic correlations. The D^2 values were significant among the 32 cultivars, which were grouped into eight clusters. For vase life, the varieties in clusters IV (Angelique, Golden Times, Raja Surender Singh of Nalagarh, and Sandra) and VIII (Sonia Mielland) were the best. On the other hand varieties of cluster VI (Raja Ram Mohan Roy and Jawani) had shown the highest flower diameter.

Key Words : Rose, cut flowers, D^2 statistics, genetic advance, heritability, vase life

Different cultivars of rose vary in their stem diameter and rigidity which ultimately affect the postharvest life [1]. Variation in vase life among the different cultivars has been attributed to differences in number of thickened cells in the xylem element and phloem fibres and presence or absence of a complete ring in the peduncles [2]. Even stomatal activity of leaves may effect flower vase life [3]. Variation in vase life, weight loss, flower diameter among the different cultivars may be due to differences in senescence behaviour by producing higher amount of ACC, ethylene forming enzyme, ethylene and due to genetic make up of the cultivars [4]. Studies on genetic variability of postharvest traits in roses are very meagre. The present study was undertaken to evaluate the genetic variability present in different cultivars, to work out the association between different parameters of rose cut flower and to classify the thirty two cut rose cultivars into different homogeneous groups according to their vaselife, flower diameter, weight loss and water uptake. There is no need

*Author for Correspondence.

to subdivide the genetic variance in vegetatively propagated crops. Only phenotypic, genotypic and interaction variance between genotypes and environment must be estimated [5]. The findings of the present study will be useful to breeders in selection of superior genotypes in the breeding programmes. The postharvest parameters will give an idea of correlated responses in the related traits while making selection for the main economic trait.

MATERIAL AND METHODS

The investigation was carried out at the Division of Floriculture and Landscaping, I.A.R.I., New Delhi during 1993-94. 32 different cultivars of *Rosa hybrida* were taken for this investigation. 16 cut flower for each cultivar were plucked randomly from 20 different rose plants from different pockets in the field. The experiment was conducted in a completely randomised design with four replications. The rose flowers were harvested in the afternoon and after the harvest, the cut roses were immediately transferred to a clean bucket containing fresh tap water. In the laboratory each cut stem was individually dipped in 60 ml of tap water in borosil test tubes. During the period of study laboratory temperatures were 22°C (day), 13°C (night) and relative humidity 70%. The observations were recorded on the following properties of cut flowers. Flower diameter; it was measured at the maximum expansion of the flower on two perpendicular axes and the values averaged. Vase life; total period in vase was recorded from dipping of cut stems of roses upto loosing of freshness and colour of petals. The end of useful life of the flowers was either marked by the appearance of bent neck symptoms or wilting of outer petals or bluing of petals. Water uptake; the difference in the amount of water in the test tubes from initial to final quantity was considered as total water uptake by cut stem. Fresh weight; the fresh weight of flowers at harvest and senescence was recorded by using a digital weighing balance.

Estimates of variability, correlations and heritability were obtained by usual method of analysis of covariance. The D^2- statistics given by Mahalanobis [6] were obtained between cultivars and used for grouping the different cultivars into homogeneous clusters by Tocher's method [7].

RESULTS AND DISCUSSION

The analysis of variance showed highly significant difference among varieties for all the four characters. The varieties means, the coefficient of variation, standard error for testing the difference between the means of the varieties and critical differences at 5% and 1% level of significance are presented in Table 1. The coefficient

Table 1. Character means, for different traits in cut flower of rose

Cultivar	Total water uptake (ml)	Vase life (days)	Weight loss (g)	Flower diameter (cm)
Angelique	23.8	12.5	1.8	6.6
Arjun	18.7	6.5	1.5	7.6
Bewitched	22.5	9.9	1.1	9.0
Cara Mia	26.2	8.5	1.4	9.0
Century-2	20.2	7.5	1.3	7.8
Christian Dior	21.2	8.5	0.4	8.2
Dr. B.P. Pal	15.2	7.2	1.0	7.6
Folklore	31.2	7.8	1.9	7.6
Golden Giant	25.0	8.2	0.5	9.6
Golden Times	23.8	9.6	2.6	7.9
Jantar mantar	14.0	7.8	1.6	7.6
Jawahar	19.2	7.9	1.9	6.1
Jawani	25.8	7.2	4.7	9.7
Kiss of Fire	15.0	5.2	1.4	7.4
Lady-X	23.5	7.0	1.1	10.3
Lehar	20.0	9.0	2.2	6.9
Madhura	15.2	9.0	1.6	6.1
Mrinalini	13.8	10.2	0.4	10.0
Nehru Centenary	32.5	9.2	0.5	8.4
Oklahoma	21.8	5.5	90.2	9.4
Preyasi	21.8	5.0	0.0	8.0
Priyadarshini	7.2	5.2	0.6	9.3
queen Elizabeth	27.0	8.8	2.7	10.0
Raja Ram Mohan Roy	25.0	6.2	3.0	11.1
Surender Singh of Nalagarh	17.0	10.8	1.8	7.4
Raktagandha	11.0	7.5	1.0	10.4
Raktina	20.5	6.8	1.3	8.9
Sandra	21.2	11.5	2.6	7.0
Sonia Meilland	37.2	11.2	2.5	8.0
Super Star	14.5	7.4	1.5	8.5
Surkhab	21.8	7.8	2.8	6.7
Violaine	14.5	6.0	2.3	7.4
Mean	20.8	8.1	1.6	8.3
S.E. (Mean)	1.41	0.49	0.27	0.39
C.V.	13.49	12.17	33.83	9.46
CD (5%)	3.90	1.36	0.75	1.09

of variation was found highest for weight loss and least for the flower diameter. The heritability phenotypic and genotypic coefficient of variation are given in Table 2. The heritability of all the four characters was found to be high and of the same order. The higher estimates of heritability may be partly attributed to presence of genotype × environment interaction which gets confounded with genotypic variance and overestimates it, as the experiment was conducted in single environment [5]. The differences between the phenotypic and genotypic coefficient of variation were small indicating the small environmental effect on the traits.

Table 2. Estimates of heritability genotypic and phenotypic coefficients of variation in cut flowers of rose

Parameter	Total water uptake (ml)	Vase life (days)	Weight loss (g)	Flower diameter (cm)
Heritability (h^2)	0.8	0.8	0.8	0.7
Genotypic C.V.	29.6	22.6	60.0	15.0
Phenotypic C.V.	32.6	25.7	68.9	17.8

The general genotypic correlations was higher than the phenotypic ones (Table 3). The water uptake had shown moderate significant genotypic and phenotypic correlations with vase life and weight loss indicating the positive effect of water uptake on vase life of the flower. The peduncle diameter had shown significant negative correlation with the vase life of the flower indicating the negative effect of peduncle diameter on the vase life. The phenotypic correlation was non-significant between vase life and weight loss, whereas they had shown significant associations at genotypic level indicating the direct relation between vase life and weight loss.

Table 3. Co-efficients of correlation among the different traits of cut flower of rose

Character	Total uptake	Vase life	Weight loss	Flower diameter
Total water uptake	-	0.29*	0.24*	0.04
Vase life	0.37**	-	0.15	–0.22
Weight loss	0.29**	0.23	-	–0.08
Flower diameter	0.09	–0.28**	–0.12	-

Note: The values above and below the diagonal are phenotypic and genotypic correlations respectively

The distribution of different varieties of cut roses in eight homogeneous clusters is given in Table 4. The first cluster has the highest number of cultivars (#13) followed by second cluster (#7) and the remaining six clusters had #2, #4, #2, #2, #1 and 1 cultivars each. The mean values of different clusters for the four characters are given in Table 5. The mean vase life is highest in cluster VIII and IV, moderate

Table 4. Distribution of different varieties of cut rose in different clusters and their intra and inter cluster D^2-values

Cluster	Varieties	Intra and intercluster D^2 value							
		I	II	III	IV	V	VI	VII	VIII
I	Arjun, Cara Mia, Christian Dior, Dr. B.P. Pal, Jantar Mantar, Jawahar, Kiss of Fire, Lehar, Madhura, Raktima, Super Star, Surkhab & Violaine	9.7	28.7	25.2	25.1	26.1	44.1	30.6	70.6
II	Bewitched, Century-2, Folklore, Golden Giant, Lady-X, Nehru Centinary & Queen Elizabeth		11.7	27.0	29.5	35.4	35.4	67.0	33.1
III	Oklahoma & Preyasi			3.6	62.2	33.6	63.6	28.8	91.2
IV	Angelique, Golden Times, Raja Surendra Singh of Nalagarh & Sandra				7.8	40.2	50.4	78.3	37.3
V	Mrinalini & Raktagandha					9.5	61.3	22.2	98.8
VI	Jawani & Raja Ram Mohan Roy						15.9	87.1	53.4
VII	Priyadarshini							-	104.2
VIII	Sonia Meilland								-

Table 5. Cluster means of the different traits in cut flowers of rose

Character \ Cluster	Character means							
	I	II	III	IV	V	VI	VII	VIII
Total water uptake	17.7	26.9	21.8	21.4	12.4	25.4	7.2	37.2
Vase life	7.4	8.5	5.2	11.0	8.8	6.8	5.2	11.2
Weight loss	1.7	1.3	0.1	2.2	0.7	3.8	0.6	2.5
Flower diameter	7.5	9.1	8.7	7.2	10.2	10.4	9.3	8.0

in cluster I, II and V and least in the remaining clusters. The weight loss found very high in cluster VI followed by cluster VIII, moderate in cluster I and II and low in the remaining four clusters. There is no specific trend in the water uptake capacity of the flowers in relation to other characters. The mean flower diameter of the clusters shows that increase in flower diameter decreases the vase life of the flowers. The intra and inter cluster D^2-values of the different clusters are given in Table 4. The intra-cluster D^2 - values, which shows the homogeneity of the cluster, was least in cluster III and highest in cluster VI. The off-diagonal values give the average inter cluster D^2-values and shows the distance between the two clusters. The higher the inter cluster D^2 - values more distant are the two clusters. The cluster VII and VIII has the highest inter cluster distance, whereas it was least between V and VII.

REFERENCES

1. J. Nowak and R. M. Rudnicki. 1990. Postharvest Handling and Storage of Cut Flowers, Florist Greens and Potted Plants, Timber Press Portland, Oregon, USA : pp 210.
2. E. Zamski, F. Starkman and N. Zieslin. 1991. Mechanical strength and anatomical structure of the peduncles of rose *Rosa Xhybrida* flowers. Israel J. Bot., **40**: 1-6.
3. S. Mayak, A. H. Halevy, S. Sagie, A. Bar-Yosef and B. Bravdo. 1974. The water balance of cut rose flowers. Physiol. Plant., **32**: 15-22
4. H. A. Kader and M. N. Rogers. 1986. Postharvest treatment of *Gerbera jamesonii*. Acta Horticulturae, **181**: 169-176.
5. G. Wricke and W. E. Weber. 1986. Quantitative Genetics and Selection in Plant Breeding, Walter de Gruyter (Berllin) & New York : pp 396.
6. P. C. Mahalanobis. 1936. On the generalised distances in statistics. Proc. Natl. Inst. Sci., India; **2**: 49-55.
7. C. R. Rao. 1952. Advanced Statistical Methods in Biometrical Research. John Willey and Sons, New York, USA.